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DE-A- 2 407 559
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Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an electrode device for high frequency thermotherapy apparatus, which is inserted into a cavity of a living body (an organism), for instance, such as rectum to effect medical treatment against cancer cells at moderately warm temperature.

Description of the Prior Art

An electrode device used for high frequency thermotherapy apparatus is generally called applicator. This applicator is made up of an electrode section for applying a high frequency electric field and a cooling section for cooling the skin for protection from burn. A high frequency thermotherapy apparatus is provided with a pair of applicators. In the thermotherapy, one applicator is inserted into a cavity of a living body (e.g. into the rectum from the anus), while the other applicator is arranged on the outer surface of the living body so as to sandwich the disease part between the two applicators. A high frequency electric field is generated between the two applicators to warm or heat the disease part (e.g. cancer cells) for thermotherapy. To cool or protect the inner and outer surface of a living body in contact with these applicators from heat, a cooling device is required for the applicator.

For the applicator arranged outside the body, since the shape of the applicator can be increased easily, it is possible to provide a sufficiently wide cooling space and surface. For the applicator to be inserted into a very narrow cavity of a living body (patient), however, it is impossible to increase the diameter of the applicator (a cavity-inserted cylindrical tube). Therefore, the space within the inserted cylindrical tube is extremely narrow. In other words, the space where an electrode is arranged or a cooling liquid is passed is every small in volume. In addition, in the prior-art cavity-inserted cylindrical body, since a cooling liquid charging port and a cooling liquid discharge port are only arranged, there exists a problem in that cooling liquid will not flow or circulate and therefore the cooling efficiency is low. When the cavity is not sufficiently cooled, there exists a danger that the mucous membrane is burnt.

An electrode device according to the precharacterising part of the claim is known from DE-A-2 407 559.

SUMMARY OF THE INVENTION

The object of the present invention is to provide an electrode device for high frequency thermotherapy apparatus, which can be cooled sufficiently and inserted into a small cavity of a living body.

The above-mentioned object is achieved by the electrode device claimed in the claim.

In the electrode device of the high frequency thermotherapy apparatus as claimed, the inner volume within the cavity-insertable cylindrical tube is perfectly divided into two spaces by the separator to form a circulation passage for a cooling liquid. Therefore, the cooling liquid supplied from a liquid charge port provided at the base member may smoothly flow into the cavity-insertable cylindrical tube, turn around the end of the electrode portion, and return to a discharge port also provided at the base member. Therefore, the cooling liquid is not pooled within the cylindrical tube and not heated to a high temperature as in the prior-art device, but the cooling liquid may always be circulated to cool the device efficiently. Since the warming target (disease part) can be efficiently warmed without heating the surface of the cavity into which the cylindrical tube is inserted, the effect of the thermotherapy apparatus can be improved.

The electrode device is constructed in such a way that the cavity-insertable cylindrical tube is removably connected to the base member under liquid tight condition. This is because the cavity-insertable cylindrical tube shall be removed for washing and replaced with a washed one or new one, thus enabling a sanitary medical treatment.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view, partly broken, showing an embodiment of electrode device for high frequency thermotherapy apparatus of the present invention;

Fig. 2 is an enlarged cross-sectional view taken along the line II-II shown in Fig. 1;

Fig. 3 is an enlarged cross-sectional view showing an essential portion of another embodiment of the electrode device for high frequency thermotherapy apparatus of the present invention; and

Fig. 4 is an cross-sectional view taken along the line IV-IV shown in Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 1 is a front view, partly broken, showing an embodiment of the electrode device for high frequency thermotherapy apparatus of the present invention, and Fig. 2 is an enlarged cross-sectional view taken along the line II-II shown in Fig. 1.

As described above, the high frequency thermotherapy apparatus includes a pair of applicators each provided with an electrode section for applying a high frequency electric field to a diseased part and a cooling section for cooling and protecting the skin surface of the body corresponding in position to the diseased part (warming or heating target). One of the applicator is inserted into the cavity of the living body, and the other of the applicator is arranged on the outer skin surface of the body at such a position as to correspond to the warming target so as to be opposed to each other.

The applicator attached to the outer skin surface of the body is the same in structure as the conventional one, therefore the description thereof being omitted herein. The applicator inserted into a cavity will now be described hereinbelow.

In Fig. 1, an applicator inserted into a cavity (an electrode device for high frequency thermotherapy apparatus) comprises a base member 1, a cylindrical tube 2 to be inserted into a cavity, a separator 3, and an electrode 4.

The base member 1 includes a cylindrical member 11 having an open end and a bottom and a connector 12 fixed to the bottom of the cylindrical member 11. A female thread is formed on the inner circumferential surface of the open end of the cylindrical member 11 so as to be coupled to the cavity-insertable cylindrical tube 2. A pipe-shaped liquid charge port 13 and a pipe-shaped liquid discharge port 14 are provided on both sides of the bottom of the cylindrical member 11. To these two ports 13 and 14, a cooling device of forced circulation type (a cooling liquid is forcedly circulated) is connected. A fitting hole 15 to which a base portion of the separator 3 is fitted is formed at the center of the bottom surface of the cylindrical member 11.

The separator 3 is composed of a liquid passage partition plate 3a of a flat type having a width roughly equal to an inner diameter of the cavity-insertable cylindrical tube 2 and a liquid charge/discharge partition plate 30 of a flat type having a width changing according to the inner diameter of the cylindrical tube 2 and to the inner diameter of the cylindrical member 11 and roughly equal to these diameters. The partition plate 3b is fixedly fitted to a fitting hole 15 formed in the cylindrical member 11. The partition plate 3a is removably connected to the partition plate 3b near the base portion of the cylindrical tube 2.

A flat electrode 4 of elongated oval shape in cross section is fixedly fitted to an end portion of the liquid passage partition plate 3a. A lead wire 41 of the electrode 4 is passed through a hole formed in the liquid passage partition plate 3a, the liquid charge/discharge partition plate 3b, and the base 1 (i.e. cylindrical member 11 and the connector 12), toward the outside.

The cavity-insertable cylindrical tube 2 is made of an electrically insulating material and is rounded at an end thereof. The base portion of the cylindrical tube 2 is formed into a large diameter portion 21. A male thread is formed at this large diameter portion 21. When this male thread is screwed into the female thread of the cylindrical member 11 (the screwed portion is designated by reference numeral 22), the cylindrical tube 2 is removably fixed to the base 1 under liquid tight condition via an O ring intervening between two end surfaces of the cylindrical tube 2 and the cylindrical member 11.

Where the cavity-insertable cylindrical tube 2 is connected to the base 1, the liquid passage partition plate 3a (including the electrode 4) which constitutes the separator 3 is positioned within the cylindrical tube 2 in such a way that a slight space is formed between the end of the electrode 4 and the inner end portion of the cylindrical tube 2 and further the inner space within the cylindrical tube 2 is bisected (divided into two upper and lower spaces) by the liquid passage partition plate 3a so as to provide a liquid going path 24 on the upper side and a liquid return path 25 on the lower side. Since the inner space of the cylindrical member 11 is also bisected into the upper portion and the lower portion by the liquid charge/discharge partition plate 3b, the liquid charge port 13 communicates with the liquid going path 24 and the liquid discharge port 14 communicates with the liquid return bath 25, thus establishing a cooling liquid circulation passage.

Fig. 3 is a cross-sectional view of a modification of the electrode 4, and Fig. 4 is a cross-sectional view taken along the line IV-IV in Fig. 3.

In the embodiment shown in Figs. 1 and 2, a flat plate-shaped electrode 4 is used. In this modification, a cylindrical electrode is adopted, as shown in Fig. 4, to more efficiently warm the target part.

When the electrode device for high frequency thermotherapy apparatus as described above is used to remedy rectum cancer, for instance, the cavity-insertable cylindrical tube 2 is inserted into the anus of a patient and the electrode 4 is positioned at the position corresponding to a warming target (disease part). In this case, when scales or graduations are marked on the outer surface of the cavity-insertable cylindrical tube 2, since the insertion depth can be known easily, it is possible to accurately position the electrode 4 at the position corresponding to he warming target. When a cooling liquid is supplied from the liquid charge port 13 into the cylindrical member 11 (the base 1), the cooling liquid flows through the going path 24, turns around the electrode 4, and returns through the return path 25, being discharged toward the

outside from the discharge port 14. Since the whole of the electrode 4 and the cavity-insertable cylindrical tube 2 is always cooled by the circulating cooling liquid, the outer surface of the living body in contact with the cylindrical tube 2 can be cooled for protection against burn, in particular the surface near the electrode 4 is sufficiently cooled so that only the diseased part between the two applicators can be efficiently warmed.

Further, since the cavity-insertable cylindrical tube 2 is removably attached to the base member 1, it is possible to remove the cylindrical tube 2 from the base member 1 for washing or to replace the body 2 with a new one, thus securing a sanitary medical treatment.

As described above, since the base member and the cavity-insertable cylindrical tube are removably connected and further a liquid circulating path is formed within the cavity-insertable cylindrical tube by the separator attached to the base member, it is possible to smoothly circulate the cooling liquid via the going and return paths even if the internal space of the cavity-insertable cylindrical tube is extremely small. Therefore, since the surface of the living body in contact with the electrode device is always cooled without being heated into a burn, it is possible to effectively warm or heat the warming target (disease part) at appropriate temperature irrespective of the position of the warming target.

Further since the cavity insertable cylindrical tube can be removed from the base member, it is possible to replace the cavity insertable cylindrical tube with a new one or wash the cylindrical tube for each medical treatment, thus realizing a sanitary medical treatment.

Claims

1. An electrode device for high frequency thermotherapy apparatus, comprising

a base having a cooling liquid charge port (13) and a cooling liquid discharge port (14),

a cavity-insertable cylindrical tube (2) closed at one end,

a separator (3) fixed to said base and arranged within the volume surrounded by said cylindrical tube (2) along the longitudinal direction thereof for partitioning said volume except for an end space at the closed end thereof opposite said base into a first and a second space (24, 25), said first space (24) communicating with said charge port (13) and said second space (25) communicating with said discharge port (14),

an electrode (4) disposed within said volume surrounded by said cylindrical tube (2), and

a circulation passage for a cooling liquid extending from said first space (24) via said end space to said second space (25),

characterized by

said cylindrical tube (2) being removably fixed to said base (1) in a liquid-tight manner, said separator (3) extending also along an inner diameter of said cylindrical tube (2) in order to define said first and second spaces (24, 25) in form of parallel longitudinal channels on opposite sides of the separator and said electrode being fixedly fitted to an end portion of said separator (3) facing said end space so as to project from said separator (3) into said unpartitioned end space.

Revendications

1. Dispositif à électrode pour appareil de thermothérapie à haute fréquence, comprenant un socle qui comporte une admission (13) d'un liquide de refroidissement et une évacuation (14) du liquide de refroidissement, un tube cylindrique (2) insérable dans une cavité et fermé à une extrémité, un séparateur (3) fixé audit socle et disposé longitudinalement à l'intérieur du volume enveloppé par ledit tube cylindrique (2) pour diviser ledit volume en un premier et un second espaces (24, 25), à l'exception d'un espace d'extrémité situé à l'extrémité fermée dudit tube qui est opposée audit socle, ledit premier espace (24) communiquant avec ladite admission (13) et le second espace (25) communiquant avec ladite évacuation (14), une électrode (4) disposée à l'intérieur dudit volume enveloppé par ledit tube cylindrique (2) et un passage de circulation destiné à un liquide de refroidissement et allant dudit premier espace (24) par ledit espace d'extrémité audit second espace (25), caractérisé en ce que ledit tube cylindrique (2) est fixé de manière amovible audit socle (1) de manière étanche aux liquides, ledit séparateur (3) étant aussi disposé le long d'un diamètre intérieur dudit tube cylindrique (2) afin de délimiter lesdits premier et second espaces (24, 25) qui ont la forme de canaux longitudinaux parallèles sur les côtés opposés du séparateur et ladite électrode étant assujettie à demeure à une partie extrême dudit séparateur (3) qui est en face dudit espace d'extrémité de manière à être saillante sur ledit séparateur (3) pour pénétrer dans ledit espace d'extrémité non divisé.

Patentansprüche

1. Elektrodenvorrichtung für ein Hochfrequenz-

Thermotherapiegerät, mit

einem Sockel mit einer Kühlflüssigkeitseinströmöffnung (13) und einer Kühlflüssigkeitsausströmöffnung (14),

einem an einem Ende verschlossenen, in einen Hohlraum einführbaren Rohr (2),

einem Separator (3), welcher am Sockel befestigt und in dem von dem zylindrischen Rohr (2) umgebenen Volumen in Längsrichtung des Rohres angeordnet ist und das Volumen mit Ausnahme eines Endraumes am abgekehrt vom Sockel liegenden verschlossenen Ende in einen ersten und zweiten Raum (24, 25) unterteilt, wobei der erste Raum (24) mit der Einströmöffnung (13), und der zweite Raum (25) mit der Ausströmöffnung (14) in Verbindung steht,

einer in dem von dem zylindrischen Rohr (2) umgebenen Volumen angeordneten Elektrode (4), und

einem Zirkulationsdurchgang für eine Kühlflüssigkeit, der sich von dem ersten Raum (24) über den Endraum zum zweiten Raum (25) erstreckt,

dadurch gekennzeichnet, daß

das zylindrische Rohr (2) flüssigkeitsdicht lösbar am Sockel (1) befestigt ist, der Separator (3) sich längs eines Innendurchmessers des zylindrischen Rohrs (2) erstreckt und den ersten und zweiten Raum (24, 25) in Form paralleler, in Längsrichtung verlaufender Kanäle auf entgegengesetzten Seiten des Separators bestimmt, und die Elektrode an einem Endabschnitt des Separators (3), der dem Endraum zugekehrt ist, so befestigt ist, daß sie vom Separator (3) in den ununterteilten Endraum hineinragt.

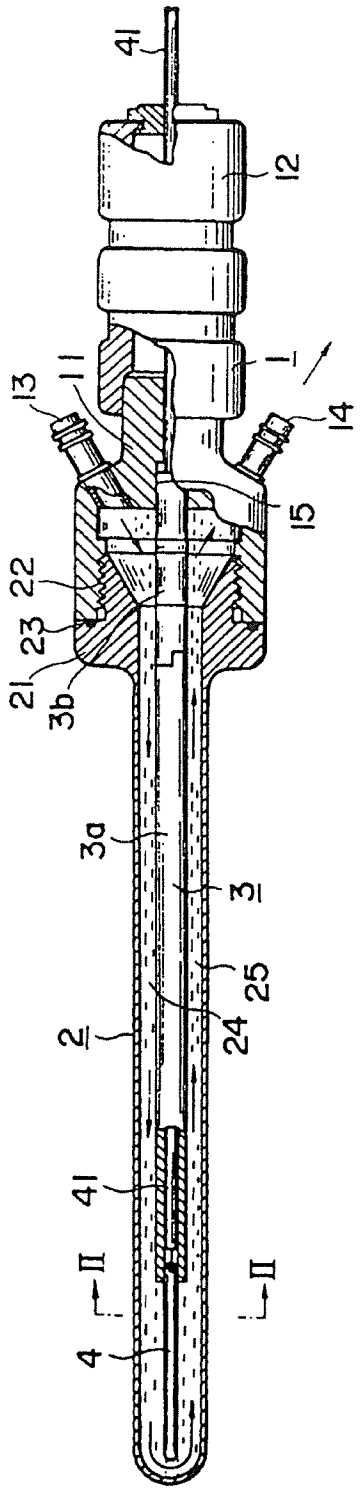

Fig.1

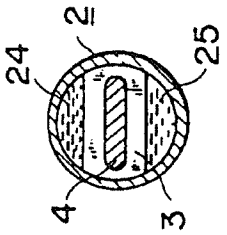

Fig.2

Fig.3

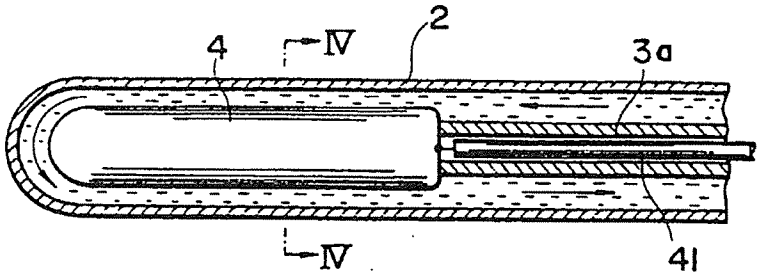

Fig.4